METROPOLITAN WATER DISTRICT

THE EFFECT OF A

FAVORABLE BOND ELECTION

ON THE

LOCAL WATER SITUATION.

JULY 29,1931.

A. L. SONDEREGGER
925 CENTRAL BUILDING
LOS ANGELES

WHT 7

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MEMBER
AMERICAN SOCIETY C. E.
AMERICAN ASS'N ENGRS.
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A. L. SONDEREGGER
CONSULTING ENGINEER
925 CENTRAL BUILDING
LOS ANGELES

July 29, 1931.

W. P. Whitsett, Chairman,
Metropolitan Water District
of Southern California,
Los Angeles California.

Dear Sir:-

Herewith is submitted a brief report bearing on certain phases of the water situation of the Metropolitan Area which will develop during the next six or seven years, that is, between now and the time when the Colorado River water becomes available, and on the probable effect of any further delay in the construction of the Aqueduct should the Metropolitan bond election fail to carry at this time.

The drought to which this country has been subjected since 1922, combined with a steadily increasing demand for water, is making itself felt to an accelerating degree, so that in certain regions water shortages or exhaustion will become acute before the arrival of Colorado River water, even under normal conditions of rainfall. In fact, in some localities, the present season has already produced this very condition.

The affected areas include the basins along the seaboard from Santa Monica to Long Beach, where sea water is intruding progressively; the foothill areas from Glendora to the Red Hills near Etiwanda, the La Habra Basin, and the Orange County

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Dear Sir:-

Los Angeles Californians.
of Southern Californians.
Metropolitan Water District
W. P. Whitsett, Chairman,

July 28, 1931.

A. L. SONDEREGGER
CONSULTING ENGINEER
832 CENTRAL BUILDING
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AMERICAN SOCIETY C. E.
MEMBER

Coastal Plain. These areas are shown in special shading on attached Plate #1. Such regions are being compelled to look for new sources of supply in adjacent basins where large groundwater storage permits of continued overdrafts.

As far as Los Angeles County is concerned, such storage is found in San Gabriel Valley, San Gabriel Coastal Plain and Los Angeles Coastal Plain. However, these basins have, since 1922, derived all, or a large part, of their use from continued overdraft. This condition has made itself felt in a marked recession of water levels, a drying up of gravity supplies and consequently a greatly increased cost production, all of which has impressed itself upon the minds of the water users and made them more apprehensive than ever of any attempt at encroachment on their rights.

With water at a premium today, and in face of increasing demands, it is expected that exports from these basins would be resisted on the ground that no surpluses exist. However, it is probable that a successful bond election and a prompt start of construction work on the Aqueduct, not only would allay any apprehension, which is now manifest as to water supplies even in the large basins, but it might also pave the way to <u>temporary exports to adjacent suffering areas, because relief would be in sight within a definite period</u>.

On the other hand, should construction of the Aqueduct be delayed, (due to failure of the bond election) the resulting uncertainty in the water situation would make itself felt immediately in higher premiums on available local supplies, in a still

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On the other hand, should construction of the Aqueduct be delayed, (due to failure of the bond election) the resulting uncertainty in the water situation would make itself felt immediately in higher premiums on available local supplies, in a still

more tense situation as regards the protection of existing rights by the many conflicting interests, and in a concerted resistance to any attempt at new exportations into other basins, regardless of the critical state of their supplies.

Even within the larger basins, where overdrafts for the time being are not disastrous, a marked conflict of interests is now developing between the rights of overlying lands (or correlative rights), and rights by appropriation. The division of interests is tending to line up the agricultural lands in opposition to the increasing development of industry and municipalities, whose concentration of large abstractions on small areas is out of all proportion to the correlative rights in the basin.

Because of the progressive increase of industrial and municipal needs, some water users will sooner or later find their rights in jeopardy and will eventually be forced to protect themselves by instituting general adjudication proceedings. The disastrous effects of such procedure cannot be over-estimated, because it would, of necessity, involve entire basins. The filing of a suit would immediately affect land and water titles to every parcel of land in the basin; the litigation would be protracted and very costly, and for the time being would put a stop to any development involving the investment of large capital, regardless of the final outcome. The latter reference applies particularly to prospective basic industries which require large water supplies, and for which clear land titles could not be delivered until the termination of the water litigation. This type of industry has formed the backbone of the growth of recent years.

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With an abundant supplementary supply in sight within a definite period, the danger of a permanent shortage vanishes and with it the cause for extensive litigation. It is, therefore, important that the construction of the Aqueduct be undertaken without delay, so that the continued progressive growth be not disturbed.

Referring to conditions in Los Angeles County, Plate #1 shows that the San Gabriel Valley and the Coastal Plain are surrounded by areas whose supplies are either in a critical condition or are rapidly approaching it, even under normal rainfall.

The present drought began in 1922 and has now continued for 9 years, with 1927 a wet year. The resulting water supply, as represented by the runoff of characteristic streams, was 59%. There is positive proof that Southern California has experienced longer periods of drought; two of these, one from 1893 to 1904 and the other from 1868 to 1883, were within periods during which rainfall records were kept, while a third, that of 1781 to 1809, is proved by historic evidence. In the report of H.B.Lynch, the statement is made that Lake Elsinore, at the end of this latter period, had dried to a swamp about one mile long, whereas no such condition existed at the end of the other two periods cited, being positive proof that this early period exceeded in severity any other known period. The water crop in percentage of the 38 year mean stream runoff from 1893 to 1931, is as follows:

1922-1931	dry	period	of	9	years,	water supply	59%
1893-1904	"	"	"	11	"	"	53%
1869-1883	"	"	"	14	"	"	68%
1781-1809	"	"	"	28	"	"	70%

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nevertheless, past precedents indicate that such a possibility must be reckoned with. It has been proved that the present drought is also affecting the Owens River supply, so that its continuance would create critical conditions affecting the larger portion of Southern California, including the City of Los Angeles.

The conclusion is inevitable, that only actual construction work on the Colorado River Aqueduct will have the psychological effect of allaying fears and producing the assurance that permanent relief is definitely provided for.

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THE EFFECT OF ADJUDICATION OF WATER RIGHTS.

An adjudication of the water rights of a basin generally involves a determination of the following:

1st - Available local water supply:

2nd - Extent of irrigable and inhabitable areas overlying the basin:

3rd - Existing prescriptive rights, including those of municipalities, factories and irrigated lands, and of exporters.

4th - The determination of the correlative right in the total water supply of each acre of land overlying the basin. This amount, determined and confirmed by court decree, defines the extent of future water development of any parcel.

In the adjudication of groundwater supplies, municipal development comes under the category of appropriations, because a municipality cannot act for the lot owners within the city limits collect-

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In the adjudication of groundwater supplies, municipal development comes under the category of appropriations, because a municipality cannot act for the lot owners within the city limits collect-

ively, nor can a municipality file on groundwater supplies for future growth. Similarly, a factory which develops water in excess of the correlative right of its tract, becomes an appropriator.

It is generally admitted that local sources are insufficient to supply all irrigable or inhabitable lands overlying Southern California basins, so that even under original conditions and before appropriations took place, the correlative right of an acre of land was less than the consumptive use of its crop, or less than 1¼ ac.ft. per acre. Under the historical development as it occurred in Southern California, large prescriptive rights have been acquired, by usage over periods exceeding five years, by municipalities, factories and irrigated lands, some of which may lie entirely outside of the basin. These rights, in case of an adjudication would also be pro-rated at the expense of the other lands in the basin, so that the resulting correlative right per acre would be less than under original conditions.

The initiation and consummation of adjudication proceedings would successively produce the following disastrous conditions:

1st - It would involve every acre of land in the basin in a costly law suit, whether it wanted it or not.

2nd - It would tie up water rights and render the value of lands uncertain, be clouding, for the time being, all titles.

3rd - It would stop major developments during the process of the suit because of the uncertainty of water supplies.

The initiation and consummation of subdivision proceedings would successively progress the following qualifications:

Jan - It would involve very little if any delay to land in the area of land use zoning classification.

Feb - It would be up to the city engineer to determine if sewer and water facilities were adequate, all fees paid.

Mar - It would depend largely on the processing of development plans by the city engineer, and the time required to secure approval of the water and sewer facilities.

Apr - It would be necessary to secure approval of the plat by the Planning Commission, and the time required to secure approval of the water and sewer facilities.

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4th - After an adjudication, new appropriations could be successfully enjoined so that the acquisition of large water rights would then be contingent upon the control of a corresponding area of land, generally in proportion of not less than one acre of land per acre foot of water per annum. Under such conditions, the development of a water supply of 50 miners inches, or 724 ac.ft. per annum by a municipality or factory would require the acquisition or control of a tract of land of not less than 724 acres, clearly an impossible situation in a rapidly growing industrial country, when it is considered that the average value of such lands is not less than $1000 per acre.

A further complication may arise in the adjudication of the water rights of Southern California basins, because basins are, as a rule, interconnected and overlapping, the supply of upper basins affecting that of those below. Excepting isolated cases, the adjudication of rights of an individual basin within a watershed will likely lead to that of the entire watershed. This would refer particularly to the San Gabriel Valley and San Gabriel Coastal Plain which are in the watershed of the San Gabriel River. The adjudication of the rights of the entire watershed of this river would be a matter involving a period of years and large expenditures of moneys. Similarly, the adjudication of the water rights of Orange County would likely involve the entire Santa Ana River Watershed.

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AREAS AFFECTED BY SEA WATER.

These areas are located along the seaboard from Santa Monica to Long Beach and to Newport Beach, and are delineated on the attached Plate #1 in vertical shading, from information obtained from the Water Resources branch of the State Department of Engineering and from the Los Angeles County Flood Control office. Available analyses indicate that the water supply within the area designated has suffered a percolation inland of sea water to the extent of producing a salt content of 14 grains, or more, per gallon, as compared with fresh water supplies farther inland, which contain as little as one grain per gallon. Fourteen grains to the gallon does not necessarily mean that the waters are unfit for domestic or for irrigation uses, but is indicative of a more or less progressive intrusion of sea water, so that it becomes merely a matter of time before the water will be unfit for use.

The area indicated by vertical shading on the map as containing 14 or more grains of salt per gallon, covers 41 square miles and at present affects the development of water supply within the cities of Venice, El Segundo, Manhattan Beach, Hermosa, Redondo, San Pedro, Wilmington, Long Beach and Seal Beach. It is concluded that these areas will have to be supplied permanently with imported water, unless it is found feasible to push the salt water back by restoration inland of the original fresh water gradient.

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AREAS WITH WATER TABLES AT OR BELOW SEA LEVEL.

These areas are also located along the seaboard from Santa Monica to Long Beach and to the mouth of the Santa Ana River. They are indicated on Plate #1 in horizontal shading and cover 155 square miles in Los Angeles County, with an estimated population of over 200,000 and 9,000 acres of irrigated lands and present abstractions of over 40,000 ac.ft. per annum. The respective area in Orange County is 37 square miles.

The basic information as to the extent of these areas has again been obtained from recent well surveys by State and County authorities, which show that static levels in certain wells are as low as 51 feet below sea level and in a great number of wells are more than 10 feet below sea level, with pumping levels correspondingly lower. There is, therefore, being produced today a marked counter gradient in the groundwater table favoring the percolation inland of salt water, because there are no physical barriers. This condition affects the water supply of Santa Monica, Venice, El Segundo, Hawthorne, Manhattan Beach, Hermosa, Redondo, Gardena, Wilmington, San Pedro, portions of Long Beach, Seal Beach, Newport Beach and Laguna.

It is apparent that although these basins have considerable fresh water stored below sea level, this storage can be utilized only to a very limited extent and that ordinary prudence makesit advisable that pumping be temporarily abandoned so that a natural recharge by fresh water can take place. Once salt water has intruded into an area, its replacement by fresh water becomes a

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difficult and slow process, because of the higher specific gravity of salt water, its lower viscosity and consequent relatively low rate of percolation. It is a problem the solution of which as yet has not been attempted.

It should be noted that the area from Santa Monica to Long Beach is situated southwesterly of the oil anticlinal, which extends from Beverly Hills to Signal Hill, and to Newport Beach, and therefore involves a basin separate from the Los Angeles County Coastal Plain and Orange County Coastal Plain. There are several gaps in this anticlinal, thru which water percolates southwesterly into the western coastal plain, but apparently not sufficient in quantity to meet present abstractions. The area also receives a water supply during heavy rainstorms, however, the surface soils are generally heavy and tight, resisting free percolation. The Los Angeles County Coastal Plain is the only available source for a substitute water supply for the seaboard areas of Los Angeles County, and it is expected that the invasion of that plain on a large scale will have to be attempted long before completion of the Aqueduct.

OVERDRAWN AND EXHAUSTED FOOTHILL BASINS.

This applies to the foothill areas from Glendora to Claremont and the Cucamonga Basin. These areas are shown on attached Plate #1 in inclined heavy shading, indicating an overdraft.

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that in this area there are over 34,000 acres in citrus groves which use approximately 66,300 ac.ft. per annum and domestic water uses by cities of 7800 ac.ft., making a total of 74,100 ac.ft. They have furthermore stated that the history of the water supply in this section is one of diminishing supply, and, in some cases, nearing exhaustion, and that the annual overdraft at present is in excess of 50,000 ac.ft.

The area affects the domestic water supply of the cities of Glendora, La Verne, Claremont, Pomona and Ontario. The capacity of individual basins along these foothills is comparatively small: this fact, combined with an overdraft and the absence of recharge over a series of dry years has produced critical conditions which demand immediate attention.

The Glendora-Claremont area is tributary to the San Gabriel river and relief, therefore, must be looked for by an invasion of San Gabriel Valley groundwater storage. The Cucamonga Basin between Claremont and Etiwanda is in the watershed of the Santa Ana river and adjacent to the Chino Basin from whence it could obtain a supplementary supply.

The Whittier and La Habra Valley is also overdrawn to such an extent as to require importation of water from the San Gabriel and Santa Ana rivers.

LARGE STORAGE BASINS OF SAN GABRIEL VALLEY AND COASTAL PLAIN OF LOS ANGELES COUNTY.

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As far as the Coastal Plain is concerned, overdrafts below sea level will not expose these areas to the intrusion of sea water for some years to come, because of the protecting barrier of the oil anticlinal. While several gaps exist in this ridge which extend to depths below sea level and permit the escape of groundwater, the exercise of reasonable caution should prevent the advance of the sea water area inland through these gaps.

In the San Gabriel Valley during the last four years, water levels have receded materially and the surface flow at the Whittier Narrows has diminished to the extent of as much as 2000 inches. These gravity supply has been replaced by pumped water. The rapidity with which wells have been dropping indicates that the farther down a basin is drawn, the more rapidly does it approach exhaustion. The large underground storage of San Gabriel Valley represents the only logical relief available for the foothill areas of Los Angeles County. Temporary invasion might be tolerated were permanent relief from Colorado River water in sight.

The Los Angeles County Coastal Plain is supplied by the Los Angeles and San Gabriel Rivers, the latter being the major source. The facility with which water supplies have been developed on this plain and the comparatively low cost have been factors favoring the location of industries. Despite the fact that no water shortage need be feared, the increased cost of production and competitive concentrated abstractions by municipalities and industries have

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created a disturbed situation and attempts at export would undoubtedly be resisted by this basin, especially if intended to be permanent. Certain exports to Torrance have been legalized by beneficial use over a period of years.

It may be mentioned that some of the larger water users of San Gabriel Valley and Los Angeles County Coastal Plain have organized themselves into the San Gabriel Valley Protective Association which employs a well-organized staff of engineers and three law firms to protect the water rights of their members.

ORANGE COUNTY

A survey of groundwater conditions in the Orange County Coastal Plain during the fall of 1930 is available in the report of the Orange County Flood Control District, dated April, 1931.

On the attached Plate #1, the areas where water stands at or below sea level are shown in vertical shading, they cover 37 square miles; those areas where the water table stands between sea level and elevation plus 30, are shown in inclined heavy shading, indicating an overdraft and comprise 160 square miles. This Coastal Plain is more exposed to the inland percolation of sea water than is that of Los Angeles County, because the gaps in the oil anticlinal are wider and located along the beach. The wells at the mouth of the Santa Ana River, which serve Newport Beach, Costa Mesa and Laguna, are only one mile from the ocean and are now pumping from below sea level.

There has been a sharp drop in the water plane from 1922 to 1930 as shown on Plate #2, amounting to 120 feet near Anaheim, 15 miles inland. The winter of 1930-31 having been a dry one, the water table

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is now below that indicated on the diagram. It is estimated that in 1930 the basin was overdrawn to the extent of 31,500 ac.ft. The population at that time was 116,000 and the irrigated area 125,000 acres.

The steady recession of the water table is the result of a drought, combined with increasing abstractions over a long period, of years, not only in Orange County, but also in Riverside and San Bernardino Counties, which have a first chance at the water supply of the Santa Ana River. It is expected that with continued growth in these three counties, groundwater levels will continue to recede and drop below sea level over large areas before Colorado River water becomes available. It will require concerted action and much forethought by the water users to tide over the interim without a serious setback in the growth of the county, as it is expected that exportation from the Los Angeles County Coastal Plain will not be tolerated. Orange County also is making a bid for industrial development which, in turn, may require comparatively large water supplies for individual factories and concentrated abstractions at rates many times those for ordinary agricultural uses.

An adjudication of rights would have the same far-reaching results in Orange County as in Los Angeles County, and in particular would interfere with municipal and industrial growth.

Respectfully submitted,

A. L. Sonderegger

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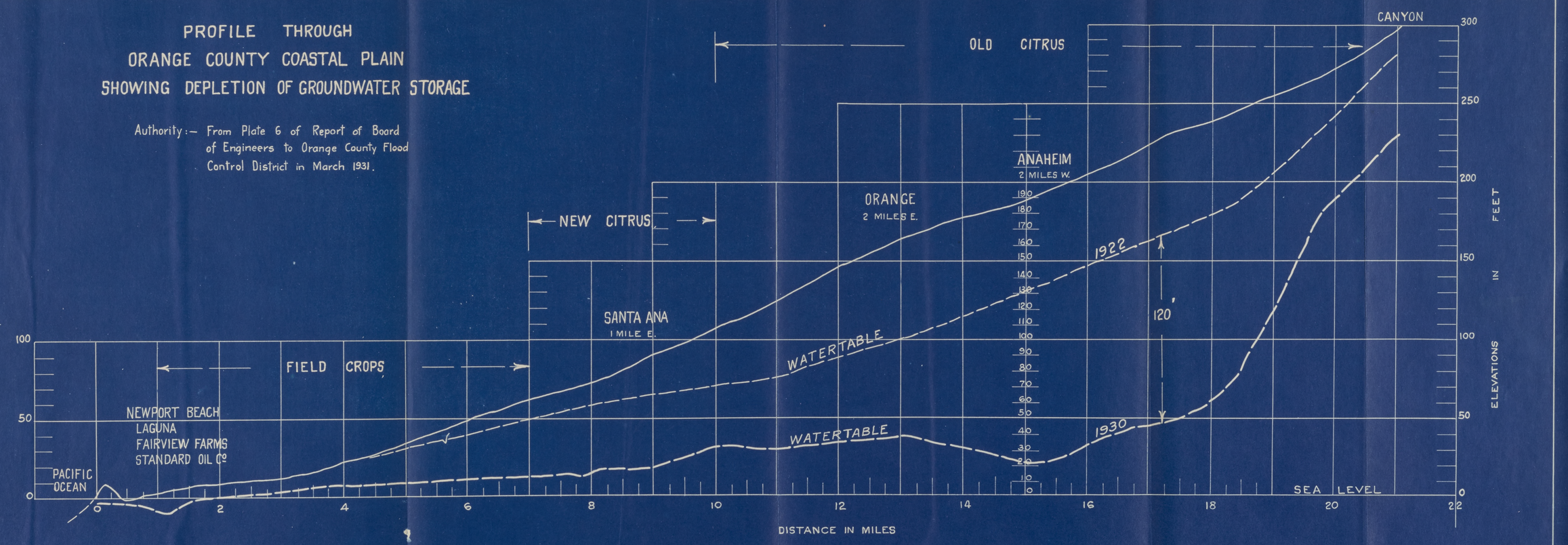
PLATE 2

PROFILE THROUGH ORANGE COUNTY COASTAL PLAIN SHOWING DEPLETION OF GROUNDWATER STORAGE

Authority:— From Plate 6 of Report of Board of Engineers to Orange County Flood Control District in March 1931.



A. J. Hendricks

17-8-01

PLATE I

Map Showing
DEPLETED GROUNDWATER BASINS IN METROPOLITAN AREA.

Scale in Miles
0 2 4 6 8 10 12 14 16 18 20

A.L. Sonderegger.
Consulting Engineer
925 Central Bldg. Los Angeles.

LEGEND

- SALTWATER INTRUSION 14 GR. PER GALLON OR MORE } --- 41 SQ. MILES
- WATERTABLE AT OR BELOW SEA LEVEL } --- 192 SQ. MILES
- GROUNDWATER SUPPLY APPROACHING CRITICAL CONDITIONS

SAN GABRIEL MTS.
SAN BERNARDINO MTS.
SANTA MONICA MTS.
SANTA ANA MTS.
PACIFIC OCEAN
PASADENA BASIN
SAN GABRIEL VALLEY
GLENDORA-CLAREMONT BASIN
CUCAMONGA BASIN
SAN BERNARDINO BASIN
SAN JOSE HILLS
CHINO BASIN
PUENTE HILLS
LOS ANGELES CO. LINE
ORANGE COUNTY
SAN BERNARDINO COUNTY LINE
COASTAL PLAIN
ORANGE COUNTY
SEAWATER INTRUSION
LOS ANGELES OIL
WATER TABLE AT OR BELOW SEA LEVEL
ANTICLINAL
Groundwater Contour
CONTOUR +30
GROUNDWATER
GLENDALE
PASADENA
SIERRA MADRE
MONROVIA
ARCADIA
AZUSA
SAN MARINO
SAN GABRIEL
ALHAMBRA
MONTEREY PARK
EL MONTE
COVINA
WEST COVINA
BEVERLY HILLS
SANTA MONICA
LOS ANGELES
VERNON
INGLEWOOD
SOUTHGATE
LYNWOOD
COMPTON
EL SEGUNDO
MANHATTAN BEACH
HERMOSA
REDONDO
SAN PEDRO HILLS
LONG BEACH
SEAWATER INTRUSION
SAN PEDRO
HUNTINGTON BEACH
NEWPORT BEACH
COSTA MESA
ANAHEIM
ORANGE
SANTA ANA
LA HABRA
POMONA
ONTARIO
CHINO
UPLAND
CLAREMONT
ETIWANDA
RIALTO
SAN BERNARDINO
COLTON
RIVERSIDE
CORONA
Temescal Wash
SANTA ANA RIVER
LOS ANGELES RIVER
RIO HONDO
SAN GABRIEL RIVER
San Jose Creek

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